

NISTTech

Silylated Resins & the Synthesis Thereof

Facile, one-step process to synthesize a wide variety of silylated polymerizable resins having a broad spectrum of properties

Description

A way to manufacture silylated resins which exhibit a strong affinity for glass substrates. On polymerization these resins yield strong, tough materials suitable for a variety of applications, especially those related to moist or aqueous environments. The flexible method controls viscosity and adhesive properties. The synthesis of these novel resins typically involves only one step and employs readily available reactants. Many of the self-adhesive resins can be utilized both as coupling agents for siliceous and other fillers, and as the organic matrices of thermoset composites. These novel resins also can be designed to have minimal polymerization shrinkage, lower stress development, low water sorption, and improved affinity for glass and similar substrates. Their silyl ether or silyl ester structure has the potential to provide a self-healing mechanism if hydrolytic degradation occurs.

These exchange reactions can be conducted in solvents, including diluent monomers, either with or without the presence of catalysts. Choice of the resin/silyl composition and reaction conditions can be used to design resins with controlled reactivity, hydrophobicity, and polymerization shrinkage.

Viscosity and shrinkage of the resins can be controlled by selection of the silylating agents. Strength and toughness are other properties that can be controlled by this technology.

Applications

- **Dentistry**
Restorative composite compositions.
- **Industrial applications**
Structural composites, caulks, adhesives, sealants, and coatings.

Advantages

- **Create a variety of designable resins**
Controllable reactions produce a wide variety of composites displaying a range of attributes.
- **Simple, easy preparation**
Single-step preparation using readily available reagents.

- **Improved characteristics**
Stronger, tougher, and more durable than currently available dental composites.

Abstract

A silylated resin suitable for use as an adhesive binder for composites and in sealant and adhesive dental applications is represented by the general formula (I): STR1 in which: R_1 is an aliphatic, cycloaliphatic, aryl, hydrocarbon, or fluorocarbon group; R_2 is the same as R_1 or a different aliphatic, cycloaliphatic, aryl, hydrocarbon, or fluorocarbon group; STR2 M_2 is the same as M_1 or a different functional or nonfunctional group selected from the group consisting of: STR3 n is 1-3; x is 1-20; and y is 1-20; which comprises the reaction product of the exchange reaction of a hydroxylated, aminated, or carboxylated acrylic resin represented by the general formula (II): STR4 in which: R_4 is an aliphatic, cycloaliphatic, aryl, hydrocarbon, or fluorocarbon group with one or more protic functional groups selected from the group consisting of: OH, N--H, and CO₂ H R_5 is H or CH₃; and R_6 is H or CH₃; with a trialkoxyorganosilane or triacyloxyorganosilane represented by the general formula (III): STR5 in which: R_7 , R_8 , and R_9 each is: STR6 R_{10} is an aliphatic, or aryl group which can optionally be substituted with a group from the group of an acrylic group, a methacrylic group, an epoxy group, and a substituted amino, hydroxyl, or carboxylic acid group such as an ester or an amide.

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References

- Expired U.S. Patent # 6,177,534 B1
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Status of Availability

This technology is available in the public domain. Please contact NIST's Office of Technology Partnerships for more information.

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